

University of Groningen

## The presence and extinction of *Elephas antiquus* Falconer and Cautley, 1847, in Europe

Mol, Dick; de Vos, John; van der Plicht, Johannes

*Published in:*  
Quaternary International

*DOI:*  
[10.1016/j.quaint.2006.06.002](https://doi.org/10.1016/j.quaint.2006.06.002)

**IMPORTANT NOTE:** You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

*Document Version*  
Publisher's PDF, also known as Version of record

*Publication date:*  
2007

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Mol, D., de Vos, J., & van der Plicht, J. (2007). The presence and extinction of *Elephas antiquus* Falconer and Cautley, 1847, in Europe. *Quaternary International*, 169(2), 149-153.  
<https://doi.org/10.1016/j.quaint.2006.06.002>

**Copyright**

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

**Take-down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

*Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.*

# The presence and extinction of *Elephas antiquus* Falconer and Cautley, 1847, in Europe

Dick Mol<sup>a,\*</sup>, John de Vos<sup>b</sup>, Johannes van der Plicht<sup>c,d</sup>

<sup>a</sup>CERPOLEX/Mammuthus, Natural History Museum Rotterdam, P.O. Box 23452, NL - 3003 KL Rotterdam, The Netherlands

<sup>b</sup>National Museum of Natural History Naturalis, P.O. Box 9517, NL - 2300 RA Leiden, The Netherlands

<sup>c</sup>Centre for Isotope Research, University of Groningen, Nijenborgh 4, NL - 9747 AG Groningen, The Netherlands

<sup>d</sup>Faculty of Archaeology, Leiden University, P.O. Box 9515, NL - 2300 RA Leiden, The Netherlands

Available online 1 February 2007

## Abstract

We discuss seven radiocarbon dates from remains of the straight-tusked elephant, *Elephas antiquus* Falconer and Cautley, 1847, from The Netherlands. These dates show that there is a strong possibility that this species became extinct much later in North Western Europe as is commonly accepted. The youngest radiocarbon date we present is 37,440 (+350, –310) BP.

© 2006 Elsevier Ltd and INQUA. All rights reserved.

## 1. Introduction

The extinct elephant, *Elephas antiquus* Falconer and Cautley, 1847, is a large elephant characterized by straight tusks. Therefore, it is known as forest or straight-tusked elephant. In the literature, there are different opinions about the nomenclature and phylogenetic hypotheses for this species. Maglio (1973) assigned this large extinct elephant to the genus *Elephas*; others (Aguirre, 1968/69) attribute it to the genus *Palaeoloxodon*. Beden (1983) considered *Palaeoloxodon* to be a subgenus of the genus *Elephas*. There are also various viewpoints concerning the taxonomy on the species level. Lister (1992, personal communication in Shoshani and Tassy, 1996) proposed that the large European and Asian extinct elephants consist of two different species: *Elephas antiquus* Falconer and Cautley, 1847, and *E. namadicus* Falconer and Cautley, 1845, respectively. This division is based on the fact that the holotype of *E. antiquus* originates from Europe, whereas the holotype of *E. namadicus* originates from India. Maglio (1973) considered the Asiatic form *E. namadicus* as a senior synonym of the European form *Elephas antiquus*. If that is true, the large elephant *Elephas antiquus/namadicus* should be known in both Europe and Asia. Here we will

restrict ourselves to the European form and use the name *Elephas antiquus*.

## 2. *E. antiquus* in western Europe

Kolfschoten (1990a) describes a Bavelian *E. antiquus* molar from the site Dorst-Surae (Noord-Brabant), which is late Early Pleistocene. However, according to Mol et al. (1999) this molar should be assigned to *Mammuthus meridionalis*, a species, which was already known from this site. As a consequence, there is no evidence that *E. antiquus* was present in The Netherlands in the Early Pleistocene. The oldest specimen in Europe is found in Silvia, Italy (Palombo and Ferretti, 2005). The superb specimens from *E. antiquus* from Isernia la Pineta, Southern Italy date to 736,000 years ago (Mol and van Essen, 1992). However, this date is being discussed (e.g. Coltorti et al., 2005). A similar age, early Middle Pleistocene, can be assigned to an *E. antiquus* molar, which is found along with a *M. meridionalis* molar in the sandpit of Linden (Hooijer, 1985). In addition, a few molars from the North Sea are also older than Late Pleistocene and show the same degree of mineralization as *M. trogontherii*. However, because stratigraphical data are lacking, definite conclusions concerning the age cannot be made.

In Europe, it was accepted for a long time that *E. antiquus* has Middle- to Late Pleistocene age, and that

\*Corresponding author.  
E-mail addresses: [dickmol@worldonline.nl](mailto:dickmol@worldonline.nl) (D. Mol),  
[vos@naturalis.nnm.nl](mailto:vos@naturalis.nnm.nl) (J. de Vos), [J.van.der.Plicht@rug.nl](mailto:J.van.der.Plicht@rug.nl) (J. van der Plicht).

*E. antiquus* became extinct at the end of the Eemian. Many specimens from this period (Middle–Late Pleistocene) are known. From Germany there exists a skeleton from the Upper Rhine area, exhibited in the Hessisches Landesmuseum at Darmstadt (Kroll, 1990). The University of Jena excavated perfectly preserved skeletons near Neumark-Nord in central Germany (Fischer, 2004). A skeleton from the Riano site near Rome is exhibited at the Geological and Paleontological Museum of the University of Rome (Maccagno, 1962). From The Netherlands and the Southern Bight of the North Sea a few finds of *E. antiquus* are known. Those are mainly molars and molar fragments. Roding (1953) described some damaged specimens of this species from the so-called ‘Holstenian’ of the Clay of Neede. Van Kolfschoten (1981, 1988, 1990b) mentioned Middle Pleistocene finds, also based on fragmentary material from a site near Rhenen. Also, the in situ finds of the sites Maastricht Belvedere 2 and 4, correspond to the Saalian, and contained remains of *E. antiquus* (Van Kolfschoten, 1988). The largest collection in The Netherlands of this species belongs to the Koninklijk Zeeuwsch Genootschap der Wetenschappen, and is stored at the Zeeuws Museum in Middelburg. The collection contains a very large hemi-mandible with a m3 and a few heavy skeleton parts, which were fished from the mouth of the Western Scheldt. A very robust humerus from the same area is stored at the Naturalis Museum in Leiden. A skull fragment of a Late Pleistocene hippo was fished from the same location. This is not the only site where hippo and straight-tusked elephant are found together. Fossils from both species were also discovered during the development of the recreational area “De Rhederlaag” near Giesbeek, in the basin of the river IJssel. Downstream along the same river, another fossil mammal association was found, again of the straight-tusked elephant with the hippo (*E. antiquus* and *Hippopotamus incognitus*) at the Hearst site (van Uum, 2003). From the bottom of the North Sea, Hooijer (1985), described for the first time a molar fragment from the straight-tusked elephant under the name *E. namadicus*. Since then more molar fragments and some complete molars were collected from the bottom of the North Sea. According to Mol et al. (1999) they have ages ranging from Middle Pleistocene to Eemian.

A few molar fragments and a complete molar of *E. antiquus* were found at the artificial beach of the Maasvlakte on the coast of the province of Zuid-Holland. According to Van Kolfschoten and Vervoort-Kerkhof (1999) these finds have to be assigned to the Weichselian Maasvlakte II fauna.

The *E. antiquus* skeleton of Aveley in Essex, Great Britain (Stuart, 1982), was found just below a skeleton of a *Mammuthus primigenius*. The age of the straight-tusked elephant was considered to be Eemian, and the woolly mammoth to be Weichselian. A similar situation occurs at the Dutch site Raalte. Bosscha Erdbrink et al. (2001) described a part of a m1 from an *E. antiquus* found by suction-dredging North of Raalte (province of Overijssel).

This fossil, and a fragment of a molar of *M. primigenius*, the woolly mammoth, originates from the Kreftenheye Formation, which consists of Late Pleistocene sediments. The fossils are in the collection of Mr. J.G. Brewer (Raalte), numbered HB65 and HB66, respectively. Remarkable are the results of the  $^{14}\text{C}$  dates of these specimens, measured at Utrecht University. The date of the *E. antiquus* is  $32,500 \pm 500$  BP (UtC-9307); the date of the *M. primigenius* is  $39,000 \pm 1000$  BP (UtC-9308). The  $^{14}\text{C}$  date of the *M. primigenius* is what would be expected, and fits within the range of many other age determinations for *M. primigenius*. However, the date of *E. antiquus* from Raalte is too young, if one assumes that *E. antiquus* withdrew from most of Europe during the end of the Eemian.

Confronted with a few geologically young specimens from Spain, Stuart (1991, 1999, 2005) suggested that *E. antiquus* survived in Southern Europe (Iberia, Italy and probably the Balkans as well) into the early part of the Last Cold Stage (LCS). Stuart (2005) admitted that the evidence for the LCS hypothesis is based on sparse records, as listed below:

- A molar from Grotta Guattari, Italy, dated by U-series isotopes and ESR to  $57 \pm 6$  ka (Schwarcz et al., 1991). Caloi and Palombo (1994) therefore assigned this material to MIS 5a-4 (80–60 ka).
- A partial skeleton from Buelna, Asturias, Northern Spain (Pinto Llona and Aguirre, 1999) with a Radiocarbon date of  $23,575 \pm 1125$  BP (but this date is rejected by Stuart (2005)).
- An unworn upper molar plate from Foz do Enxarrique, Portugal, with U-series dates (on horse teeth) of ca. 33–34 ka (Sousa and Figueiredo, 2001).
- Two deciduous molars from the locality Cueva del Castillo, northern Spain, with the following Radiocarbon dates measured at Oxford University (LQME Project):  $42,900 \pm 1400$  BP (OxA-10187) and  $>47,300$  (OxA-10188) (Stuart, 2005).

Stuart (2005) wrote: “To summarize, at present there is reasonable, but not conclusive, evidence for the survival of *Palaeoloxodon antiquus* to 40–50 ka or perhaps as late as 33–34 ka in Iberia, significantly later than the Last Interglacial. However, the evidence for late survival in Italy, beyond MIS 5a, is weak.”

The  $^{14}\text{C}$  date of Raalte,  $32,500 \pm 500$  BP, is similar to the  $^{14}\text{C}$  date of Iberia. However, Stuart (2005) wrote about the specimen and the date: “Other fossils, apparently from the same deposit [Raalte], include both cold stage elements such as *Rangifer tarandus* and *Ovibos moschatus*, and interglacial taxa such as *Dama dama* and *Capreolus capreolus*.” He continues by stating: “As this is a single date from an unstratified context, and in view of the total lack of other post-Eemian records of *P. antiquus* outside Southern Europe, this single date should not be accepted



Fig. 1. *Elephas antiquus* Falconer and Cautley, 1847. Left upper M3, Collection Albert Hoekman, Urk, CM-DM 80. Maximum antero-posterior length of occlusal surface is 244 mm. Locality: Southern Bight of the North Sea.

until there is further supporting evidence, including corroborative dates from another laboratory.”

### 3. New Late Pleistocene radiocarbon dates from The Netherlands

Recently, more other data from The Netherlands became available. First, a fragment of a molar, m3, was collected from the bottom of the North Sea between the British Isles and The Netherlands (coordinates: 51°17'200" North–03°10'500" East) by Mr. J. Brinkman, fishing vessel SL 27 in August 2001. This specimen is stored in the collection of Dick Mol, Hoofddorp. The sample was  $^{14}\text{C}$  dated by Groningen University. Unfortunately, the dentine did not contain any collagen, which is the datable fraction for the  $^{14}\text{C}$  method. Only “residual” material could be retrieved. The  $^{14}\text{C}$  date for this fossil is  $9880 \pm 130$  BP (GrA-19879). Following radiocarbon practice, dates from such material cannot be considered reliable. Another complete left upper molar (M3) is the sample CM-DM 80 (Fig. 1), which is stored in the collection of Mr. A. Hoekman, Urk, The Netherlands, and originates from the Southern Bight of the North Sea (near the coast of the province of Zeeland and the mouth of the Western Scheldt). For this sample the collagen is preserved; it is also dated by Groningen University as 37,440 (+350, –310) BP (GrA-25815). The measurements of this molar are presented in Table 1.

Four more samples of trawled *E. antiquus* remains have been radiocarbon dated. The results are given in Table 2. It appears that all samples are older than the background,

Table 1  
Measurements of *Elephas antiquus* Number CM-DM80

CM-DM 80	Collection Mr. Albert Hoekman, Urk.
Left upper M3	
Max. length occlusal surface (mm)	244
Max. width occlusal surface (mm)	88
Max. height (mm)	218
Number of plates	10.5 plates, front of molar completely worn down to the roots
$^{14}\text{C}$ date (BP)	37,440 (+350, –310) (GrA-25815)
$^{13}\delta$ (‰)	–20.28

which is determined by dating  $^{14}\text{C}$ -free anthracite and corresponds to an age of 45,000 BP. Thus, the samples are older than 45 ka BP.

All Radiocarbon dates were obtained from collagen, prepared from the bone samples using standard chemical pretreatment techniques (Mook and Streurman, 1983). The  $^{14}\text{C}$  concentration is measured by accelerator mass spectrometry (AMS). The Groningen AMS facility (laboratory code GrA) is described in van der Plicht et al. (2000).

Typical quality parameters for the  $^{14}\text{C}$  dates are the carbon content of the collagen (in %) and the content of the stable Carbon isotope  $^{13}\text{C}$ , expressed  $^{13}\delta$  (in ‰). The  $^{13}\delta$  values are given in the tables and are all within normal range. The organic content of the collagen for these dates are also within normal range (40–45%).

This in contrast with the corresponding values for the questionable material mentioned above (GrA-19879).

Table 2  
Radiocarbon dated *Elephas antiquus* remains

Catalog number and skeletal part	Locality	Groningen AMS number	<sup>14</sup> C age (BP)	<sup>13</sup> δ (‰)
CM-DM 89Mandibula (Mol Collection)	Eastern Scheldt near Colijnsplaat	GrA-30740	>45,000	−20.70
CM-DM 91 First costa (Mol Collection)	Western Scheldt near West-Kappele	GrA-30590	>45,000	−21.20
CM-DM 92 Upper molar fragment (Mol Collection)	Mouth of the Western Scheldt	GrA-30591	>45,000	
CM-DM 97 Molar fragment De Wavrin Collection – Bruxelles	Near the Brown Ridge/North Sea	GrA-30592	>45,000	−20.57

The <sup>13</sup>δ value for the dated material is −30.47‰; the organic carbon content is 2.5%. Both numbers indicate that the datable fraction did not consist of collagen in this case.

#### 4. Conclusions

To conclude, there are now two <sup>14</sup>C dates measured by two different and independent laboratories (Utrecht and Groningen), which seem to point towards *E. antiquus* also becoming extinct later than the Eemian in Northern Europe. We would like to suggest that these data should not be ignored, and we strongly suggest that more samples should be dated—by radiocarbon and other methods like ESR because of the <sup>14</sup>C age limit of 45–50 ka. The goal is to prove or disprove the hypothesis of *E. antiquus* surviving also in North-western Europe into the early part of the LCS, which implicates that the paleo-ecology should be reconsidered.

#### Acknowledgments

The authors gratefully acknowledge the help in various ways the following people: Klaas Post (Urk), Jan Brinkman (Ouddorp), Albert Hoekman (Urk), Cor Strang (Leiden) and Hellin de Wavrin (Bruxelles). Larry D. Agenbroad (Hot Springs, South Dakota) for the invitation to present a part of the results, mentioned in this paper, at the second World of Elephants Congress, which was held in September 2005 in Hot Springs, South Dakota. We would like to thank Ralf-Dietrich Kahlke (Weimar) and Marco Ferretti (Florence) for reviewing the manuscript.

#### References

- Aguirre, E., 1968/69. Revisión sistemática de los “Elephantidae” por su morfología y morfometría dentaria. - Estudios Geológicos, (Madrid), 24, 25.
- Beden, M., 1983. Family Elephantidae. In: Harris, J.M. (Ed.), Koobi For a Research Project, vol. 2. The Fossil Ungulates: Proboscidea, Perissodactyla, and Suidae. Clarendon Press, Oxford, pp. 40–129.
- Bosscha Erdbrink, D.P., Brewer, J.G., Mol, D., 2001. Some remarkable Weichselian elephant remains. Deinsea 8, 21–26.
- Caloi, L., Palombo, M.R., 1994. Biocronologia e paleoecologia delle mammalofaune del Pleistocene medio dell'Italia Centrale. Studi Geologici Camerti (Special volume) 1994 (B), 503–514.
- Coltorti, M., Feraud, G., Marzoli, A., Peretto, C., Ton-That, T., Voinchet, P., Bahain, J.-J., Minelli, A., Thun Hohenstein, U., 2005. New [40]Ar/[39]Ar, stratigraphic and palaeoclimatic data on the Isernia La Pineta Lower Palaeolithic site, Molise, Italy. Quaternary International 131, 11–22.
- Fischer, K., 2004. Die Waldelefanten von Neumark-Nord und Gröbern. Praehistoria Thuringica, 47–62.
- Hooijer, D.A., 1985. Plio/Pleistocene elephantid, equid and rhinocerotid remains from dredging operations at Linden and Maren-Kessel (Noord-Brabant, The Netherlands). Lutra 28, 31–37.
- Kolfschoten, T. van, 1981. On the Holsteinian? and Saalian mammal fauna from the ice-pushed ridge near Rhenen (The Netherlands). Mededelingen Rijks Geologische Dienst 35, 223–251.
- Kolfschoten, T. van, 1988. The evolution of the mammal fauna in The Netherlands and the Middle Rhine Area (Western Germany) during the late Middle Pleistocene. Dissertatie, Rijksuniversiteit Utrecht, 1–157.
- Kolfschoten, T. van, 1990a. The Early Biharian Mammal Faunas from Bavel and Dorst-Surae. In: Kahlke, H.D. (Ed.), Das Pleistozän von Untermassfeld bei Meiningen; zur biostratigraphischen Korrelation unterpleistozäner Fundstellen im europäisch-asiatischen Raume. Quartärpaläontologie 8, 265–272.
- Kolfschoten, T. van, 1990b. The evolution of the mammal fauna in the Netherlands and the Middle Rhine Area (Western Germany) during the Late Middle Pleistocene. Mededelingen Rijks Geologische Dienst 43 (3), 1–69.
- Kolfschoten, T. van, Vervoort-Kerkhoff, Y., 1999. The Pleistocene and Holocene mammalian assemblages from the Maasvlakte near Rotterdam (the Netherlands), with special reference to the Ovibovini *Soergelia minor* and *Praeovibos cf. priscus*. In: Reumer, J.W.F., De Vos, J. (Eds.), Elephants have a Snorkel! Papers in Honour of Paul Y. Sondaar. Deinsea 7, 369–382.
- Kroll, W., 1990. Der Waldelefant von Crumstadt. Ein Beitrag zur Osteologie des Waldelefanten *Elephas (Palaeoloxodon) antiquus* Falc. and Cautl. (1847). Inaug. Diss., Tierärztl. Kak., Univ. München.
- Maccagno, A.M., 1962. Gli elefanti fossili di Riano (Roma). Geologica Romana 1, 33–132.
- Maglio, V.J., 1973. Origin and evolution of the Elephantidae. Transactions of the American Philosophical Society 63, 1–149.
- Mol, D., van Essen, H., 1992. De mammoet; sporen uit de ijstijd. BZZTOH, Den Haag, 1–139.
- Mol, D., De Vos, J., Reumer, J.W.F., 1999. *Praeovibos priscus* (Bovidae, Artiodactyla, mammalia) from the North Sea and aspects of its paleoecology. In: Reumer, J.W.F., De Vos, J. (Eds.), 1999. Elephants have a snorkel! Papers in Honour of Paul Y. Sondaar. Deinsea 7, 223–232.
- Mook, W.G., Streurman, H.J., 1983. Physical and chemical aspects of Radiocarbon dating. Pact Publications 8, 31–55.
- Palombo, M.R., Ferretti, M.P., 2005. The Italian elephant fossil record: knowledge, problems and perspectives. Quaternary International 126–128, 107–136.
- Pinto Llona, A.C., Aguirre, E., 1999. Presencia del Elefante Antiguo *Elephas (Palaeoloxodon) antiquus* en La Cueva de la Silluca (Buelna,



- Asturias). In: Excavaciones Arqueologicas en Asturias 1995–1998, vol. 4. Principado de Asturias, Cosejeria de Cultura, pp. 225–232.
- Roding, G.M., 1953. *Elephas antiquus* uit Neede. Publicaties der Nederlandse Geologische Vereniging 8 (15) (1950–1954), 293–294.
- Schwarcz, H.P., Bietti, A., Bunhay, W.M., Stiner, M.C., Grün, R., Segre, A., 1991. On the re-examination of Grotta Guattari: uranium-series and electro-spin-resonance dates. *Current Anthropology* 32 (3), 313–316.
- Shoshani, J., Tassy, P., 1996. *The Proboscidea: Trends in Evolution and Palaeocology*. Oxford University Press, Oxford, pp. 1–472.
- Sousa, M.F., Figueiredo, S.M., 2001. The Pleistocene elephants of Portugal. In: Cavarretta, G., et al. (Eds.), *The World of Elephants*. Consiglio Nazionale delle Ricerche, Rome, pp. 611–616.
- Stuart, A.J., 1982. *Pleistocene vertebrates in the British Isles*. Longman, London, New York, pp. 1–212.
- Stuart, A.J., 1991. Mammalian extinctions in the late Pleistocene of Northern Eurasia and North America. *Biological Reviews* 66, 453–562.
- Stuart, A.J., 1999. Late Pleistocene megafaunal extinctions; a European perspective. In: MacPhee, R.D.E. (Ed.), *Extinctions in Near Time; Causes, Contexts and Consequences*. Kluwer Academic/Plenum Publishers, New York.
- Stuart, A.J., 2005. The extinction of woolly mammoth (*Mammuthus primigenius*) and straight-tusked elephant (*Palaeoloxodon antiquus*) in Europe. *Quaternary International* 126–128, 171–177.
- Uum, R. van, 2003. Zandwinning ‘Haerst’ bij Zwolle, een vreemde eend in het riviereengebied. *Grondboor en Hamer* 57 (6), 101–112.
- van der Plicht, J., Wijma, S., Aerts, A.T., Pertuisot, M.H., Meijer, H.A.J., 2000. The Groningen AMS facility: status report. *Nuclear Instruments and Methods B* 172, 58–65.